

For release on delivery
10:30 a.m. EST
January 3, 2010

Monetary Policy and the Housing Bubble

by

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at the

Annual Meeting of the American Economic Association

Atlanta, Georgia

January 3, 2010

The financial crisis that began in August 2007 has been the most severe of the post-World War II era and, very possibly--once one takes into account the global scope of the crisis, its broad effects on a range of markets and institutions, and the number of systemically critical financial institutions that failed or came close to failure--the worst in modern history. Although forceful responses by policymakers around the world avoided an utter collapse of the global financial system in the fall of 2008, the crisis was nevertheless sufficiently intense to spark a deep global recession from which we are only now beginning to recover.

Even as we continue working to stabilize our financial system and reinvigorate our economy, it is essential that we learn the lessons of the crisis so that we can prevent it from happening again. Because the crisis was so complex, its lessons are many, and they are not always straightforward. Surely, both the private sector and financial regulators must improve their ability to monitor and control risk-taking. The crisis revealed not only weaknesses in regulators' oversight of financial institutions, but also, more fundamentally, important gaps in the architecture of financial regulation around the world. For our part, the Federal Reserve has been working hard to identify problems and to improve and strengthen our supervisory policies and practices, and we have advocated substantial legislative and regulatory reforms to address problems exposed by the crisis.

As with regulatory policy, we must discern the lessons of the crisis for monetary policy. However, the nature of those lessons is controversial. Some observers have assigned monetary policy a central role in the crisis. Specifically, they claim that excessively easy monetary policy by the Federal Reserve in the first half of the decade helped cause a bubble in house prices in the United States, a bubble whose inevitable

collapse proved a major source of the financial and economic stresses of the past two years. Proponents of this view typically argue for a substantially greater role for monetary policy in preventing and controlling bubbles in the prices of housing and other assets. In contrast, others have taken the position that policy was appropriate for the macroeconomic conditions that prevailed, and that it was neither a principal cause of the housing bubble nor the right tool for controlling the increase in house prices. Obviously, in light of the economic damage inflicted by the collapses of two asset price bubbles over the past decade, a great deal more than historical accuracy rides on the resolution of this debate.

The goal of my remarks today is to shed some light on these questions. I will first review U.S. monetary policy in the aftermath of the 2001 recession and assess whether the policy was appropriate, given the state of the economy at that time and the information that was available to policymakers. I will then discuss some evidence on the sources of the U.S. housing bubble, including the role of monetary policy. Finally, I will draw some lessons for future monetary and regulatory policies.¹

U.S. Monetary Policy, 2002-2006

I will begin with a brief review of U.S. monetary policy during the past decade, focusing on the period from 2002 to 2006. As you know, the U.S. economy suffered a moderate recession between March and November 2001, largely traceable to the ending of the dot-com boom and the resulting sharp decline in stock prices. Geopolitical uncertainties associated with the terrorist attacks of September 11, 2001, and the invasion

¹ My remarks will rely heavily on material drawn from Dokko and others (2009). However, neither those authors nor my other colleagues in the Federal Reserve System are responsible for the interpretations and conclusions I draw in these remarks.

of Iraq in March 2003, as well as a series of corporate scandals in 2002, further clouded the economic situation in the early part of the decade.

Slide 1 shows the path, from the year 2000 to the present, of one key indicator of monetary policy, the target for the overnight federal funds rate set by the Federal Open Market Committee (FOMC). The Federal Reserve manages the federal funds rate, the interest rate at which banks lend to each other, to influence broader financial conditions and thus the course of the economy. As you can see, the target federal funds rate was lowered quickly in response to the 2001 recession, from 6.5 percent in late 2000 to 1.75 percent in December 2001 and to 1 percent in June 2003. After reaching the then-record low of 1 percent, the target rate remained at that level for a year. In June 2004, the FOMC began to raise the target rate, reaching 5.25 percent in June 2006 before pausing. (More recently, as you know, and as the rightward portion of the slide indicates, rates have been cut sharply once again.) The low policy rates during the 2002-06 period were accompanied at various times by “forward guidance” on policy from the Committee. For example, beginning in August 2003, the FOMC noted in four post-meeting statements that policy was likely to remain accommodative for a “considerable period.”²

The aggressive monetary policy response in 2002 and 2003 was motivated by two principal factors. First, although the recession technically ended in late 2001, the recovery remained quite weak and “jobless” into the latter part of 2003. Real gross domestic product (GDP), which normally grows above trend in the early stages of an economic expansion, rose at an average pace just above 2 percent in 2002 and the first

² In January 2004, the Committee expressed an intention to be “patient” regarding the removal of monetary policy accommodation. In May 2004, a month before the Committee began to increase its target for the federal funds rate, it said that accommodation was likely to be removed at a pace that would be “measured.” For discussions of the potential benefits of such communication, particularly in the face of possible deflationary risks, see Eggertsson and Woodford (2003) and Woodford (2007).

half of 2003, a rate insufficient to halt continued increases in the unemployment rate, which peaked above 6 percent in the first half of 2003.³ Second, the FOMC's policy response also reflected concerns about a possible unwelcome decline in inflation. Taking note of the painful experience of Japan, policymakers worried that the United States might sink into deflation and that, as one consequence, the FOMC's target interest rate might hit its zero lower bound, limiting the scope for further monetary accommodation. FOMC decisions during this period were informed by a strong consensus among researchers that, when faced with the risk of hitting the zero lower bound, policymakers should lower rates preemptively, thereby reducing the probability of ultimately being constrained by the lower bound on the policy interest rate.⁴

Evaluating the Tightness or Ease of Monetary Policy

Although macroeconomic conditions certainly warranted accommodative policies in 2002 and subsequent years, the question remains whether policy was nevertheless easier than necessary. Since we cannot know how the economy would have evolved under alternative monetary policies, any answer to this question must be conjectural.

One approach used by many who have addressed this question is to compare Federal Reserve policies during this period to the recommendations derived from simple policy rules, such as the so-called Taylor rule, developed by John Taylor of Stanford University (Taylor, 1993). This approach is subject to a number of limitations, which are

³ Many saw the relatively weak recovery as reflecting a "capital overhang" left over from the rapid pace of investment in information technology during the boom. According to this view, the capital overhang both inhibited new capital investment and, by leading to ongoing productivity improvements, also limited the need for employers to add workers to meet the relatively moderate increases in final demand that were forthcoming. As noted in the text, geopolitical uncertainties as well as corporate scandals added to the uncertainties faced by employers.

⁴ For discussion of the Japanese experience and appropriate policies near the zero bound, see Fuhrer and Madigan (1997), Reifschneider and Williams (2000), and Ahearne and others (2002).

important to keep in mind.⁵ Notably, simple policy rules like the Taylor rule are only rules of thumb, and reasonable people can disagree about important details of the construction of such rules. Moreover, simple rules necessarily leave out many factors that may be relevant to the making of effective policy in a given episode--such as the risk of the policy rate hitting the zero lower bound, for example--which is why we do not make monetary policy on the basis of such rules alone. For these reasons, even strong proponents of simple policy rules generally advise that they be used only as guidelines, not as substitutes for more complete policy analyses; and that, to ensure robustness, the recommendations of a number of alternative simple rules should be considered (Taylor, 1999a). That said, as much of the debate about monetary policy after the 2001 recession has made use of such rules, I will discuss them here as well.

The well-known Taylor rule relates the prescribed setting of the overnight federal funds rate--the interest rate targeted by the FOMC in its making of monetary policy--to two factors: (1) the deviation, in percentage points, of the current inflation rate from policymakers' longer-term inflation objective; and (2) the so-called output gap, defined as the percentage difference between current output (usually defined as real GDP) and the "normal" or "potential" level of output. In symbols, the standard form of the Taylor rule is given by the equation shown in Slide 2. In this equation, i_t is the prescribed value of the policy interest rate in a given period t ; $\pi_t - \pi^*$ is the deviation of the actual inflation rate π from its target π^* in period t ; and $y_t - y_t^*$, the "output gap," is the deviation of actual real output y from potential output y^* in period t . The parameters a and b are

⁵ Kohn (2007) discusses some of these limitations and anticipates some of the points made in my remarks today.

positive numbers that describe how strongly the policy rate should respond to deviations of inflation from its target and of output from its potential.

As we would expect, the Taylor rule tells policymakers that interest rates should be higher when inflation is above target, $(\pi_t - \pi^*) > 0$, or when output is above its potential, $(y_t - y_t^*) > 0$. Taylor (1993) estimated the long-run real value of the federal funds rate to be about 2 percent. The equation for the Taylor rule accordingly shows that when inflation and output are equal to their targets, the federal funds rate--which is expressed here in nominal terms--should equal 2 plus the rate of inflation. Equivalently, when inflation and output equal their targets, the real value of the federal funds rate should equal 2 percent.

To make the Taylor rule equation shown in Slide 2 operational, one needs to specify numerical values for the coefficients a and b , choose appropriate indicators of inflation and output, and specify a target rate for inflation and a measure of potential output. In his 1993 paper introducing his eponymous rule, Taylor suggested setting both a and b equal to 0.5. So, for example, according to the original Taylor rule, if output rises 1 percent relative to its potential, then, all else equal, the Federal Reserve should raise its policy rate by 0.5 percent, or 50 basis points. Following Taylor's suggestions for parameter values, in Slide 3 we show by the dashed red line the values of the federal funds rate implied by the Taylor rule for the period from 2000 to the present, with inflation measured by the consumer price index (CPI), the Fed's assumed inflation target set to 2 percent, output measured by real GDP, and the output gap as estimated retrospectively by the Federal Reserve's primary forecasting model, the FRB/US model.

The Taylor rule prescription is juxtaposed with the actual path of the policy rate taken from Slide 1, again shown in blue.

The comparison displayed in Slide 3 provides the most commonly cited evidence that monetary policy was too easy during the period from 2002 to 2006, as the actual federal funds rate is below the values implied by the Taylor rule--by about 200 basis points on average over this five-year period (Taylor, 2007).

Of course, the validity of that conclusion depends on whether the specific assumptions and measurements used to construct the Taylor rule's policy prescription are appropriate. Room for disagreement exists. For example, some empirical and simulation evidence suggests that the responsiveness of policy to the output gap, given by the parameter b in the Taylor rule equation, should be higher than the value of 0.5 originally chosen by Taylor.⁶ Higher values of b lead the Taylor rule to recommend somewhat lower policy rates during recessions and their aftermaths.

The prescriptions of the Taylor rule may also depend sensitively on how inflation and the output gap are measured. The difficulties in measuring the output gap, particularly in real time, are well known. The choice of inflation measure may also be consequential. In his original 1993 paper, Taylor chose to measure inflation using the GDP deflator. As noted, the Taylor rule policy prescription shown in Slide 3 is based on the familiar CPI measure of inflation. For its part, during the past decade, the FOMC has typically focused on inflation as measured by the price index for personal consumption expenditures (PCE), because that measure is less dominated than is the CPI by the imputed rent of owner-occupied housing, and for other technical reasons. As it happens,

⁶ Taylor (1999b) contains a set of studies comparing economic performance in a range of economic models under alternative rules and parameter settings.

the choice of inflation measure matters for the interpretation of this episode, as alternative measures gave policymakers somewhat different signals. Notably, core PCE inflation for 2003 was initially reported, in the first quarter of 2004, as having slowed to about 1 percent, and it appeared to be on a steep downward trajectory.⁷ These data heightened concerns about deflation on the FOMC. In contrast, the CPI data released at the same time showed core inflation for 2003 of about 2 percent. In this case, data revisions ultimately raised estimates of PCE inflation for that period, implying that deflation was less of a risk than was thought at the time. But that such revisions would occur could not be known in advance, and policy decisions, of course, must be made based on the information available at the time.

For my purposes today, however, the most significant concern regarding the use of the standard Taylor rule as a policy benchmark is its implication that monetary policy should depend on *currently observed* values of inflation and output. In particular, the Taylor rule recommendation shown in Slide 3 relates the prescribed policy interest rate to the inflation rate and output gap that correspond to the same quarter in which the policy decision was made.⁸ However, because monetary policy works with a lag, effective monetary policy must take into account the *forecast* values of the goal variables, rather than the current values. Indeed, in that spirit, the FOMC issues regular economic projections, and these projections have been shown to have an important influence on policy decisions (Orphanides and Wieland, 2008).

⁷ Inflation measures are on a four-quarter basis. Core inflation excludes the prices of food and energy. Because it excludes the most volatile components of the price index, core inflation was often used by the FOMC as an indicator of the underlying trend of inflation.

⁸ More precisely, because inflation is measured on a four-quarter basis, the current inflation rate corresponds to the rate of price increase over the current quarter and the prior three quarters.

The distinction between current and forecast values does not always matter much, as (for example) high levels of inflation or output today may signal high levels of those variables in the future. However, over the past decade, the distinction between current and forecast inflation has been an important one. On several occasions during this period, surges in energy prices led to increases in overall inflation. According to the standard Taylor rule, whose policy prescription depends on the current value of inflation, these episodes should have led to a significant tightening of monetary policy. However, both the FOMC and private forecasters expected these increases in energy prices to subside--correctly, as it turned out--and therefore did not much adjust their medium-term *forecasts* for inflation. Consequently, policy was not tightened as much as would have been called for by the standard Taylor rule. Put another way, the standard Taylor rule makes no distinction between increases in inflation expected to be temporary and those expected to be longer lasting. In practice, however, policymakers have responded less to increases in inflation that they expect to be temporary, a reasonable strategy given that monetary policy affects inflation only with a significant lag.

Slide 4 shows the quantitative implications of this point. The actual paths of the policy rate, in blue, and the policy prescription implied by the standard Taylor rule, the dashed red line, are the same as in Slide 3. Also shown, as a dotted green line, is the monetary policy path prescribed by an alternative version of the Taylor rule that replaces the current rate of inflation on the right-hand side with a forecast of inflation over the current and subsequent three quarters. Forecasts are those that were actually made in real time, that is, at the time at which the corresponding policy rate was chosen. For the period through 2004, these forecasts are the staff forecasts (the so-called Greenbook

forecasts) that were prepared for each policy meeting. Because Greenbook forecasts for the period after 2004 are not yet publicly available, from 2005 on the forecasts are constructed from the publicly released, contemporaneous projections of FOMC participants, using methods developed by Athanasios Orphanides and Volker Wieland (2008).⁹ In addition, consistent with the practices of the FOMC, inflation is measured by the PCE price index as was available in real time, instead of by the CPI.¹⁰

As Slide 4 shows, the alternative Taylor rule prescribes a path for policy that is much closer to that followed throughout the decade, including recent years. In other words, when one takes into account that policymakers should and do respond differently to temporary and longer-lasting changes in inflation, monetary policy following the 2001 recession appears to have been reasonably appropriate, at least in relation to a simple policy rule.

Which version of the Taylor rule--the standard version, that uses current values of inflation, or the alternative version, that employs inflation forecasts--is the more reliable guide? I have explained my preference for using inflation forecasts rather than actual inflation in the policy rule: Monetary policy works with a lag, and therefore policy decisions must be forward looking. One might still prefer the simplicity of the standard Taylor rule that uses current inflation values. However, note from Slide 4 that a

⁹ FOMC projections between 2005 and 2007 are obtained from *Monetary Policy Report to the Congress*, published in February and July (available at www.federalreserve.gov/monetarypolicy/mpr_default.htm); projections for core inflation are converted to projections for headline inflation based on staff calculations that in turn rely on energy futures prices. Starting in 2008, FOMC inflation forecasts, for both core and headline inflation, become available four times each year in the *Summary of Economic Projections* (see, for example, Board of Governors of the Federal Reserve System (2009), "Minutes of Federal Open Market Committee, January 9, 21, and 29-30, 2008," press release, February 20, www.federalreserve.gov/newsevents/press/monetary/20080220a.htm).

¹⁰ In the same spirit, we also replace the output gap as measured retrospectively by the FRB/US model with the output gap from that model as measured in real time. This change has no significant effect on the policy prescriptions over most of the period.

proponent of the standard rule would have recommended that the FOMC raise the policy rate to a range of 7 to 8 percent through the first three quarters of 2008, just after the recession peak and just before the intensification of the financial crisis in September and October--a policy decision that probably would not have garnered much support among monetary specialists. In contrast, Slide 4 shows that the version of the Taylor rule based on forecast inflation (in green dots) explains both the course of monetary policy earlier in the past decade as well as the decision not to respond aggressively to what did in fact turn out to be a temporary surge in inflation in 2008. This comparison suggests that the Taylor rule using forecast inflation is a more useful benchmark, both as a description of recent FOMC behavior and as a guide to appropriate policy.

Although monetary policy from 2002 to 2006 appears to have been reasonably consistent with the Federal Reserve's mandated goals of maximum sustainable employment and price stability, we have not yet addressed the possibility that accommodative policies--though perhaps appropriate for achieving medium-term inflation and output goals--inadvertently contributed to the housing bubble. I turn now to that question.

Monetary Policy and the Housing Bubble

To set the stage for the discussion, Slide 5 shows the annual increase in nominal house prices from 1978 to the present.¹¹ After some years of slow growth, U.S. house

¹¹ These data are based on repeat sales of specific homes, which helps to correct for changes in the composition of home sales, and include information on homes financed outside of the government-sponsored enterprises, Fannie Mae and Freddie Mac.

An important, and perhaps underappreciated, issue is that measurement of house prices has improved considerably since the early part of the past decade. The LoanPerformance index on which Slide 5 is based corrects for changes in the composition of sales through the use of repeat sales, as noted in the text. During the first half of the past decade, however, the only publicly available house price indexes making that important correction were based on data taken from mortgages purchased by the government-sponsored enterprises, Fannie Mae and Freddie Mac. However, because they were based on homes

prices began to rise more rapidly in the late 1990s. Prices grew at a 7 to 8 percent annual rate in 1998 and 1999, and in the 9 to 11 percent range from 2000 to 2003. Thus, the beginning of the run-up in housing prices predates the period of highly accommodative monetary policy. Shiller (2007) dates the beginning of the boom in 1998. On the other hand, the most rapid price gains were in 2004 and 2005, when the annual rate of house price appreciation was between 15 and 17 percent. Thus, the timing of the housing bubble does not rule out some contribution from monetary policy.

To try to assess the importance of that possible contribution, in the remainder of my remarks I will consider briefly two related questions. First, the cumulative increase in housing prices shown in Slide 5 is quite large. Can accommodative monetary policies during this period reasonably account for the *magnitude* of the increase in house prices that we observed? If not, what does account for it? Second, house prices rose significantly during this period in many industrialized countries, not just in the United States. If monetary policy was an important source of house price appreciation in the United States, it seems reasonable to expect that, in an international comparison, countries with easier monetary policies should have been more likely to have significant rises in house prices as well. Is that the case?

With respect to the magnitude of house-price increases: Economists who have investigated the issue have generally found that, based on historical relationships, only a small portion of the increase in house prices earlier this decade can be attributed to the

purchased using so-called conforming mortgages, these indexes missed price movements in many houses financed with jumbo, alt-A, and subprime mortgages. See Dokko and others (2009).

stance of U.S. monetary policy.¹² This conclusion has been reached using both econometric models and purely statistical analyses that make no use of economic theory.

To demonstrate this finding in a simple way, I will use a statistical model developed by Federal Reserve Board researchers that summarizes the historical relationships among key macroeconomic indicators, house prices, and monetary policy (Dokko and others, 2009). The statistical technique employed in this model, known as vector autoregression, is familiar to econometricians who seek to analyze the joint evolution of a collection of data series over time. The model incorporates seven variables, including measures of economic growth, inflation, unemployment, residential investment, house prices, and the federal funds rate, and it is estimated using data from 1977 to 2002.¹³ For our purposes, the value of such a model is that it can be used to predict the behavior of any of the variables being studied, assuming that historical relationships hold and that the other variables in the system take on their actual historical values.

Slide 6 illustrates the application of this procedure to the federal funds rate and housing prices over the period from 2003 to 2008. In the left panel of the figure, the solid line shows the actual history of the federal funds rate. The shaded area in the figure is constructed using the results of the statistical model; it shows the range of possible outcomes that would be considered “normal” for the federal funds rate, assuming that the other six variables included in the model took their actual values during the years 2003 through 2008. Values of the federal funds rate that fall in the shaded area are relatively

¹² See, for example, Del Negro and Otrok (2007), Jarocinski and Smets (2008), Edge, Kiley, and Laforte (2009), and Iacoviello and Neri (forthcoming).

¹³ See Dokko and others (2009) for details. The authors stop the sample in 2002 to exclude the period in question.

“close to” (technically, within 2 standard deviations of) the corresponding forecast values. In line with our earlier discussion, the left panel of the figure suggests that, although monetary policy during the period following the 2001 recession was accommodative, it was not inconsistent with the historical experience, given the macroeconomic environment of the time.

The right panel of the figure shows the forecast behavior of house prices during the recent period, taking as given macroeconomic conditions and the actual path of the federal funds rate. As you can see, the rise in house prices falls well outside the predictions of the model. Thus, when historical relationships are taken into account, it is difficult to ascribe the house price bubble either to monetary policy or to the broader macroeconomic environment.

A possible objection to this conclusion is that, because of changes in methods of housing finance, the responsiveness of house prices to monetary policy may have been different in the past decade than it was in the 1980s and 1990s. For example, during 2003 and 2004, about one-third of mortgage applications were for adjustable-rate mortgage (ARM) products. Low policy rates feed through to monthly mortgage payments more directly when the mortgage interest rate is adjustable and tied to short-term rates. This linkage could rationalize a stronger effect of monetary policy on house prices in the more recent period (Iacoviello and Neri, forthcoming).

Some evidence on this question is provided in Slide 7, which shows illustrative initial monthly mortgage payments for a median-priced house for different types of mortgages.¹⁴ The interest rates used in calculating these payments are actual averages for prime borrowers for the period from 2003 to 2006, as provided by Freddie Mac. A

¹⁴ Calculations are for a house price of \$225,000 and a 20 percent down payment.

comparison of the initial monthly payment for a fixed-rate 30-year mortgage and an ARM shows that the ARM payment is about 16 percent lower, a consequential but not dramatic difference. The ARM payment is not substantially lower than the fixed-rate payment because it includes amortization of principal and a spread over the index interest rate.¹⁵ Moreover, less accommodative monetary policy would not have had a substantial effect on ARM payments. Using the Board's principal macroeconomic model, staff simulated the effects on the economy and on mortgage rates of a monetary policy that followed the original 1993 Taylor rule, taking into account the feedback effects from tighter policy to the economy.¹⁶ Under this scenario, they found that the initial ARM rate would have been about 0.71 percentage point higher than in the baseline and that the initial monthly payment for an ARM borrower would have increased by only about \$75. This result does not suggest that moderately tighter monetary policy would have dissuaded many potential ARM borrowers.

Slide 7 also shows initial monthly payments for some alternative types of variable-rate mortgages, including interest-only ARMs, long-amortization ARMs, negative amortization ARMs (in which the initial payment does not even cover interest costs), and pay-option ARMs (which give the borrower considerable flexibility regarding the size of monthly payments in the early stages of the contract). These more exotic mortgages show much more significant reductions in the initial monthly payment than

¹⁵ The figures in Slide 7, which are for prime borrowers, also take no account of the fact that subprime borrowers using ARM products typically faced both higher interest rates and additional fees.

¹⁶ The simulation covered the period from 2003 through 2005. The year 2006 was excluded because actual policy and that prescribed by the 1993 Taylor rule were not significantly different in that year. When the 1993 Taylor rule is assumed to govern monetary policy, the simulated federal funds rate averages 2.6 percent from 2003 to 2005, 70 basis points higher than in the baseline. The increase in the federal funds rate is less than the difference shown in Slide 4 because of feedback effects working through the economy; a less accommodative policy rule reduces output and inflation, which in turn limits the increase in rates implied by the policy rule.

could be obtained through a standard ARM. Clearly, for lenders and borrowers focused on minimizing the initial payment, the choice of mortgage type was far more important than the level of short-term interest rates.

The availability of these alternative mortgage products proved to be quite important and, as many have recognized, is likely a key explanation of the housing bubble. Slide 8 shows the percentage of variable-rate mortgages originated with various exotic features, beginning in 2000. As you can see, the use of these nonstandard features increased rapidly from early in the decade through 2005 or 2006. Because such features are presumably not appropriate for many borrowers, Slide 8 is evidence of a protracted deterioration in mortgage underwriting standards, which was further exacerbated by practices such as the use of no-documentation loans. The picture that emerges is consistent with many accounts of the period: At some point, both lenders and borrowers became convinced that house prices would only go up. Borrowers chose, and were extended, mortgages that they could not be expected to service in the longer term. They were provided these loans on the expectation that accumulating home equity would soon allow refinancing into more sustainable mortgages. For a time, rising house prices became a self-fulfilling prophecy, but ultimately, further appreciation could not be sustained and house prices collapsed. This description suggests that regulatory and supervisory policies, rather than monetary policies, would have been more effective means of addressing the run-up in house prices. I will return to this point in my conclusion.

Let me turn now to the international evidence on the link between monetary policy and house price appreciation. Some cross-country evidence on this link is shown

in Slide 9. The figure is drawn from a recent study of 20 industrial countries by the International Monetary Fund (IMF) (Fatás and others, 2009) and replicated by Board staff. The vertical axis of the figure shows the change in real (inflation-adjusted) house prices in each country from the fourth quarter of 2001 until the third quarter of 2006, a period that spans the sharpest period of price appreciation in most countries. Countries represented by diamonds that are further “north” in Slide 9 had relatively greater house price appreciation over this period. You can see from the figure that house price appreciation in the United States, though of course large in absolute terms, was actually less than that in the majority of countries in the sample.

The horizontal axis of the figure, following the IMF study, shows the degree of monetary policy ease or tightness in each country, measured by the average deviation of policy in each country from the prescriptions of a standard version of the Taylor rule over the corresponding period. Countries shown further to the left in the figure had more accommodative monetary policies over the period, relative to the predictions of the Taylor rule. The United States is shown as having a relatively accommodative policy, as you can see; however, that conclusion is driven in part by the use of current rather than forecast inflation in the Taylor rule, the point I discussed earlier. Interestingly, essentially all of these countries had monetary policies easier than that prescribed by the Taylor rule, as shown by the fact that every country is situated on or to the left of the vertical axis in the figure.¹⁷

¹⁷ Note that the figure ascribes different degrees of monetary ease to different countries within the euro area; although these countries share the common monetary policy of the European Central Bank, differences across countries in inflation and output gaps imply that the degree of policy accommodation *relative to economic conditions in each country* can differ. In particular, holding constant the interest rate set by the European Central Bank, the Taylor rule will tend to impute easier monetary policies to countries with strong economies. Of course, all else equal, a strong economy, even if its strength is unrelated to monetary policy, should experience more robust house prices. Consequently, the relationship shown in

As Slide 9 shows, the relationship between the stance of monetary policy and house price appreciation across countries is quite weak. For example, 11 of the 20 countries in the sample had both tighter monetary policies, relative to the standard Taylor-rule prescriptions, and greater house price appreciation than the United States. The overall relationship between house prices and monetary policy, shown by the solid line, has the expected slope (tighter policy is associated with somewhat slower house price appreciation). However, the relationship is statistically insignificant and economically weak; moreover, monetary policy differences explain only about 5 percent of the variability in house price appreciation across countries.

What does explain the variability in house price appreciation across countries? In previous remarks I have pointed out that capital inflows from emerging markets to industrial countries can help to explain asset price appreciation and low long-term real interest rates in the countries receiving the funds--the so-called global savings glut hypothesis (Bernanke, 2005, 2007). Today is not the appropriate time to revisit that hypothesis in any detail, but I would like to take a moment to show that accounting for capital inflows is likely to prove fruitful for explaining cross-country differences. Slide 10, which is analogous to Slide 9, shows the relationship between capital inflows and house price appreciation for the same set of countries as in the previous slide. Also as in the previous slide, house price appreciation is shown on the vertical axis of the figure. The horizontal axis shows the increase in the current account (equivalently, the increase in capital inflows) for each country, measured as a percentage of GDP. The downward

Slide 9 could potentially overstate the causal relationship between monetary policy and house price appreciation. For the group of euro-zone countries included in Slide 9, the slope of the relationship between house prices and monetary policy accommodation is economically more consequential but not statistically significant ($t = -1.55$, $R^2 = 0.23$).

slope of the relationship is as expected--countries in which current accounts worsened and capital inflows rose (shown in the left half of the figure) had greater house price appreciation over this period.¹⁸ However, in contrast to the previous slide, the relationship is highly significant, both statistically and economically, and about 31 percent of the variability in house price appreciation across countries is explained.¹⁹ This simple relationship requires more interpretation before any strong conclusions about causality can be drawn; in particular, we need to understand better why some countries drew stronger capital inflows than others. I will only note here that, as more accommodative monetary policies generally reduce capital inflows, this relationship appears to be inconsistent with the existence of a strong link between monetary policy and house price appreciation.

Conclusions and Policy Implications

My objective today has been to review the evidence on the link between monetary policy in the early part of the past decade and the rapid rise in house prices that occurred at roughly the same time. The direct linkages, at least, are weak. Because monetary policy works with a lag, policymakers' response to changes in inflation and other economic variables should depend on whether those changes are expected to be temporary or longer-lasting. When that point is taken into account, policy during that period--though certainly accommodative--does not appear to have been inappropriate, given the state of the economy and policymakers' medium-term objectives. House prices began to rise in the late 1990s, and although the most rapid price increases occurred when short-term interest rates were at their lowest levels, the magnitude of house price gains

¹⁸ Ahearne and others (2005) obtain similar results.

¹⁹ The slope coefficient of -3.93 is statistically significant at the 1 percent level ($t = -2.84$, $p = 0.0109$).

seems too large to be readily explainable by the stance of monetary policy alone.

Moreover, cross-country evidence shows no significant relationship between monetary policies and the pace of house price increases.

What policy implications should we draw? I noted earlier that the most important source of lower initial monthly payments, which allowed more people to enter the housing market and bid for properties, was not the general level of short-term interest rates, but the increasing use of more exotic types of mortgages and the associated decline of underwriting standards. That conclusion suggests that the best response to the housing bubble would have been regulatory, not monetary. Stronger regulation and supervision aimed at problems with underwriting practices and lenders' risk management would have been a more effective and surgical approach to constraining the housing bubble than a general increase in interest rates. Moreover, regulators, supervisors, and the private sector could have more effectively addressed building risk concentrations and inadequate risk-management practices without necessarily having had to make a judgment about the sustainability of house price increases.

The Federal Reserve and other agencies did make efforts to address poor mortgage underwriting practices. In 2005, we worked with other banking regulators to develop guidance for banks on nontraditional mortgages, notably interest-only and option-ARM products. In March 2007, we issued interagency guidance on subprime lending, which was finalized in June. After a series of hearings that began in June 2006, we used authority granted us under the Truth in Lending Act to issue rules that apply to all high-cost mortgage lenders, not just banks. However, these efforts came too late or

were insufficient to stop the decline in underwriting standards and effectively constrain the housing bubble.

The lesson I take from this experience is not that financial regulation and supervision are ineffective for controlling emerging risks, but that their execution must be better and smarter. The Federal Reserve is working not only to improve our ability to identify and correct problems in financial institutions, but also to move from an institution-by-institution supervisory approach to one that is attentive to the stability of the financial system as a whole. Toward that end, we are supplementing reviews of individual firms with comparative evaluations across firms and with analyses of the interactions among firms and markets. We have further strengthened our commitment to consumer protection. And we have strongly advocated financial regulatory reforms, such as the creation of a systemic risk council, that will reorient the country's overall regulatory structure toward a more systemic approach. The crisis has shown us that indicators such as leverage and liquidity must be evaluated from a systemwide perspective as well as at the level of individual firms.

Is there any role for monetary policy in addressing bubbles? Economists have pointed out the practical problems with using monetary policy to pop asset price bubbles, and many of these were illustrated by the recent episode. Although the house price bubble appears obvious in retrospect--all bubbles appear obvious in retrospect--in its earlier stages, economists differed considerably about whether the increase in house prices was sustainable; or, if it was a bubble, whether the bubble was national or confined to a few local markets. Monetary policy is also a blunt tool, and interest rate increases in 2003 or 2004 sufficient to constrain the bubble could have seriously weakened the

economy at just the time when the recovery from the previous recession was becoming established.

That said, having experienced the damage that asset price bubbles can cause, we must be especially vigilant in ensuring that the recent experiences are not repeated. All efforts should be made to strengthen our regulatory system to prevent a recurrence of the crisis, and to cushion the effects if another crisis occurs. However, if adequate reforms are not made, or if they are made but prove insufficient to prevent dangerous buildups of financial risks, we must remain open to using monetary policy as a supplementary tool for addressing those risks--proceeding cautiously and always keeping in mind the inherent difficulties of that approach. Clearly, we still have much to learn about how best to make monetary policy and to meet threats to financial stability in this new era. Maintaining flexibility and an open mind will be essential for successful policymaking as we feel our way forward.

References

- Ahearne, Alan, Joseph Gagnon, Jane Haltmaier, Steven Kamin, and others (2002). "Preventing Deflation: Lessons from Japan's Experience in the 1990s," International Finance Discussion Papers 72. Washington: Board of Governors of the Federal Reserve System, June.
- Ahearne, Alan, John Ammer, Brian Doyle, Linda Kole, and Robert Martin (2005). "House Prices and Monetary Policy: A Cross-Country Study," International Finance Discussion Papers 841. Washington: Board of Governors of the Federal Reserve System, September.
- Bernanke, Ben S. (2005). "The Global Savings Glut and the U.S. Current Account Deficit," speech delivered at the Sandridge Lecture, Virginia Association of Economics, Richmond, Va., March 10, www.federalreserve.gov/boarddocs/speeches/2005/200503102/default.htm.
- Bernanke, Ben S. (2007). "Global Imbalances: Recent Developments and Prospects," at the Bundesbank Lecture, Berlin, Germany, September 11, www.federalreserve.gov/newsevents/speech/bernanke20070911a.htm.
- Del Negro, Marco, and Christopher Otrok (2007). "99 Luftballons: Monetary Policy and the House Price Boom across U.S. States," *Journal of Monetary Economics*, vol. 4, pp. 1962-85.
- Dokko, Jane, Brian Doyle, Michael T. Kiley, Jinill Kim, Shane Sherlund, Jae Sim, and Skander Van den Heuvel (2009). "Monetary Policy and the Housing Bubble," Finance and Economics Discussion Series 2009-49. Washington: Board of Governors of the Federal System, December, www.federalreserve.gov/pubs/feds/2009/200949/200949abs.html.
- Edge, Rochelle M., Michael T. Kiley, and Jean-Philippe Laforte (2008). "The Sources of Fluctuations in Residential Investment: A View from a Policy-Oriented DSGE Model of the U.S. Economy," paper presented at the 2009 American Economic Association annual meeting, held January 3-5, www.aeaweb.org/assa/2009/retrieve.php?pdfid=372.
- Eggertsson, Gauti, and Michael Woodford (2003). "The Zero Interest-Rate Bound and Optimal Monetary Policy," *Brookings Papers on Economic Activity*, vol. 1, pp. 139-211.
- Fatás, Antonio, Prakash Kannan, Pau Rabanal, and Alasdair Scott (2009). "Lessons for Monetary Policy from Asset Price Fluctuations," in *World Economic Outlook* (Fall), chapter 3. Washington: International Monetary Fund, www.imf.org/external/pubs/ft/weo/2009/02/pdf/c3.pdf.

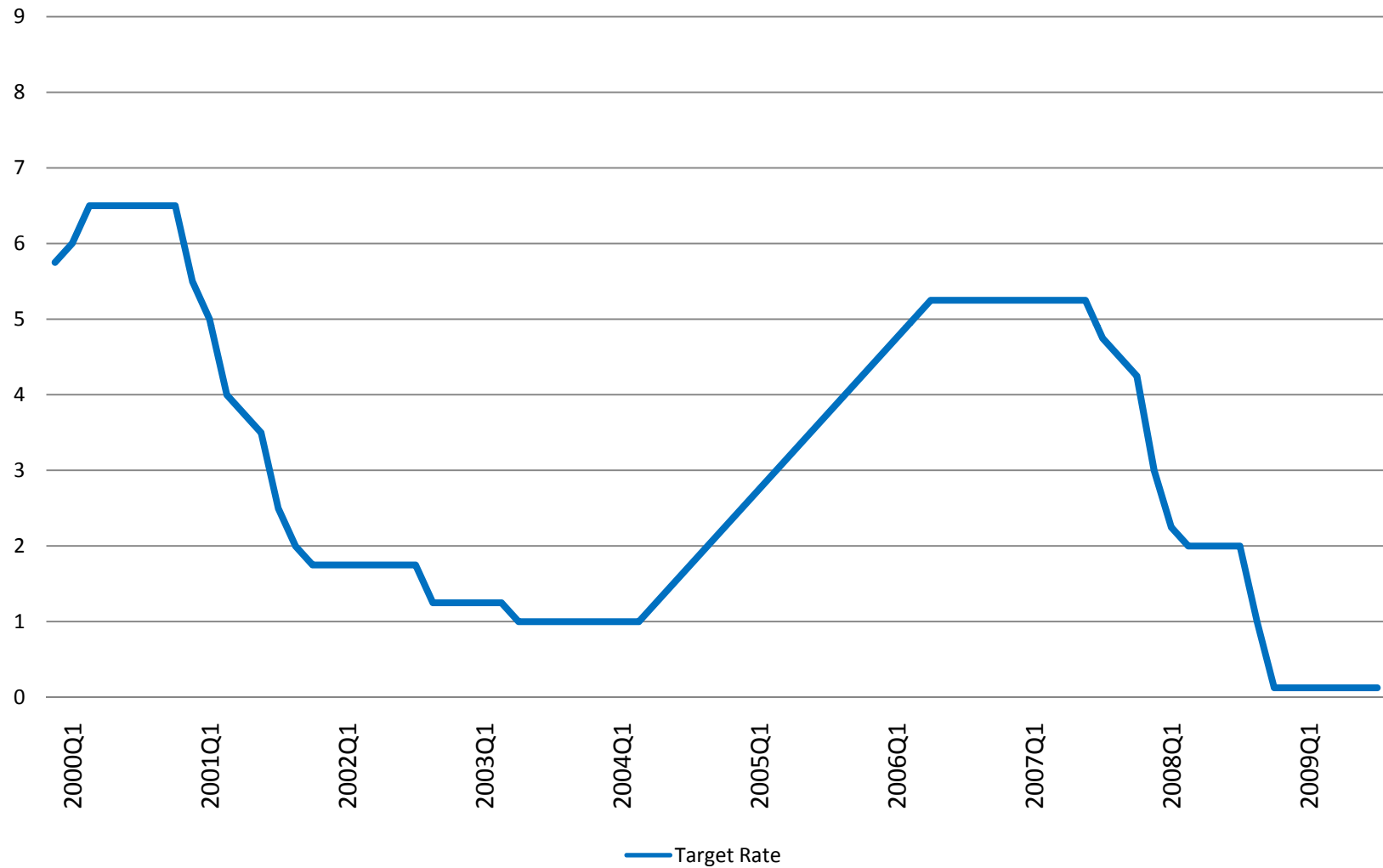
- Fuhrer, Jeffrey C. and Brian F. Madigan, 1997. "Monetary Policy When Interest Rates Are Bounded at Zero," *The Review of Economics and Statistics*, vol. 79 (November), pp 573-85.
- Iacoviello, Matteo, and Stefano Neri (forthcoming). "Housing Market Spillovers: Evidence from an Estimated DSGE Model," *American Economic Journals: Macroeconomics*.
- Jarociński, Marek, and Frank R. Smets (2008). "House Prices and the Stance of Monetary Policy," Federal Reserve Bank of St. Louis, *Review*, vol. 90 (July/August), pp. 339-65, www.research.stlouisfed.org/publications/review/08/07/Jarocinski.pdf.
- Kohn, Donald L. (2007). "John Taylor Rules," speech delivered at "Conference on John Taylor's Contributions to Monetary Theory and Policy," Federal Reserve Bank of Dallas, Dallas, Tex., October 12, www.federalreserve.gov/newsevents/speech/kohn20071012a.htm.
- Orphanides, Athanasios, and Volker Wieland (2008). "Economic Projections and Rules of Thumb for Monetary Policy," Federal Reserve Bank of St. Louis, *Review*, vol. 90 (July/August), pp. 307-24.
- Reifschneider, David, and John C. Williams (2000). "Three Lessons for Monetary Policy in a Low Inflation Era," Federal Reserve Bank of Boston Conference Series, pp. 936-78. Boston: Federal Reserve Bank of Boston.
- Shiller, Robert J. (2007). "Understanding Recent Trends in House Prices and Homeownership," in *Proceedings* of the symposium "Housing, Housing Finance, and Monetary Policy." Kansas City: Federal Reserve Bank of Kansas City, pp. 89-123, www.kansascityfed.org/publicat/sympos/2007/PDF/Shiller_0415.pdf.
- Taylor, John B. (1993). "Discretion versus Policy Rules in Practice," *Carnegie-Rochester Conference Series on Public Policy*, vol. 39 (December), pp. 195-214.
- Taylor, John B. (1999a). "An Historical Analysis of Monetary Policy Rules," in John B. Taylor, ed., *Monetary Policy Rules*. Chicago: University of Chicago Press.
- Taylor, John B., ed. (1999b). *Monetary Policy Rules*. Chicago: University of Chicago Press.
- Taylor, John B. (2007). "Housing and Monetary Policy," NBER Working Paper Series 13682. Cambridge, Mass.: National Bureau of Economic Research, December, www.nber.org/papers/w13682.pdf.
- Woodford, Michael (2007). "The Case for Forecast Targeting as a Monetary Policy Strategy," *Journal of Economic Perspectives*, vol. 21 (4), pp. 3-24.

Monetary Policy and the Housing Bubble

Ben S. Bernanke

Chairman, Board of Governors
of the Federal Reserve System

The Target Federal Funds Rate



Source: Federal Reserve Board.

Evaluating the Tightness or Ease of Monetary Policy

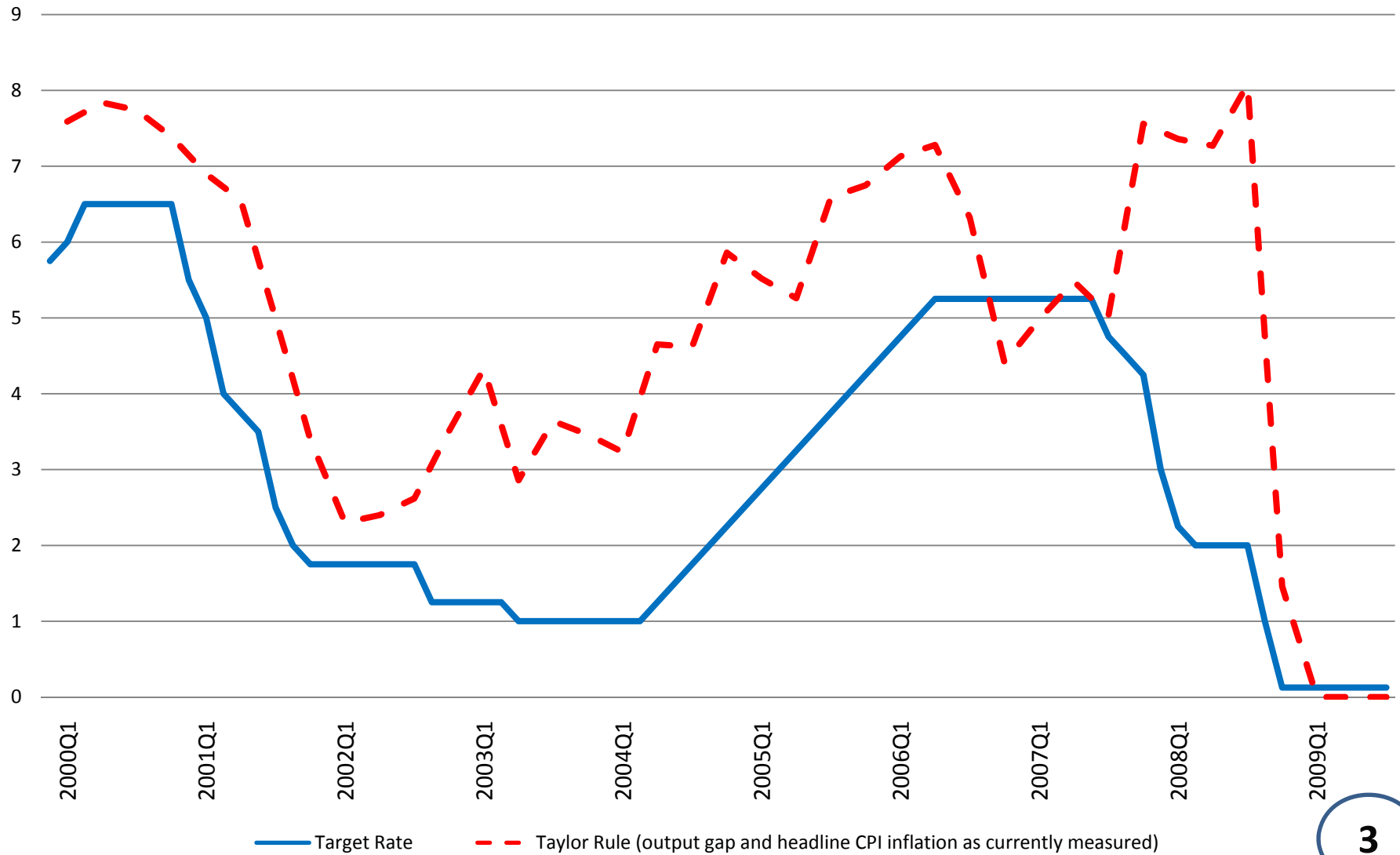
General form of the Taylor rule:

$$i_t = 2 + \pi_t + a(\pi_t - \pi^*) + b(y_t - y_t^*)$$

where

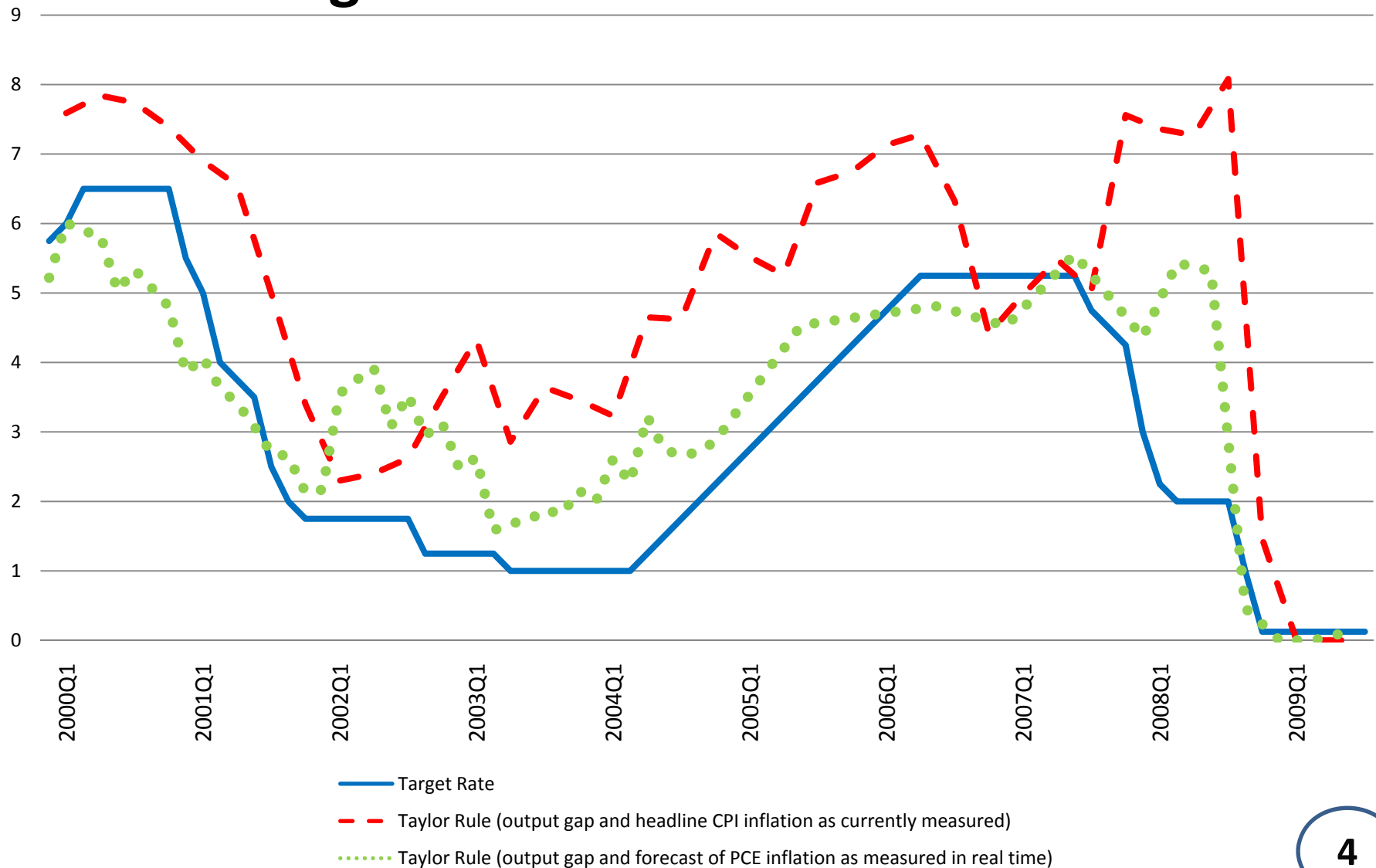
- i_t is the prescribed value of the policy interest rate in a given period t ;
- $\pi_t - \pi^*$ is the deviation of the actual inflation rate π_t from its target π^* in period t ;
- $y_t - y_t^*$, the “output gap,” is the deviation of actual real output y_t from potential output y_t^* in period t ; and
- a and b are positive numbers.

The Target Federal Funds Rate and the Taylor (1993) Rule Prescriptions



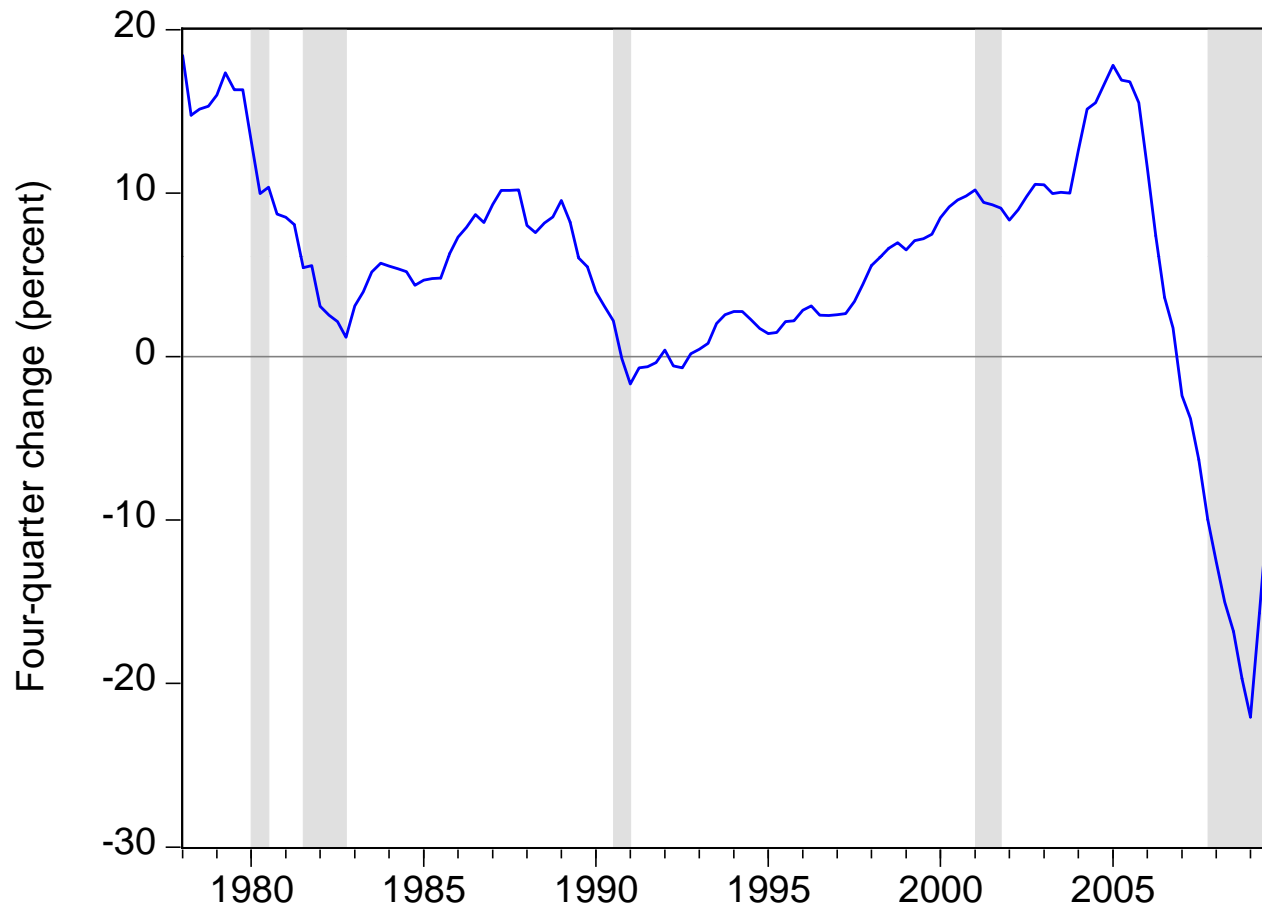
Source: Federal Reserve Board, Bureau of Labor Statistics, Bureau of Economic Analysis, and Federal Reserve staff calculations.

The Target Rate and the Taylor Rule Prescriptions Using Real-Time Inflation Forecasts



Source: Federal Reserve Board, Bureau of Labor Statistics, Bureau of Economic Analysis, and Federal Reserve staff calculations.

Rate of Increase in House Prices 1978:Q1-2009:Q3

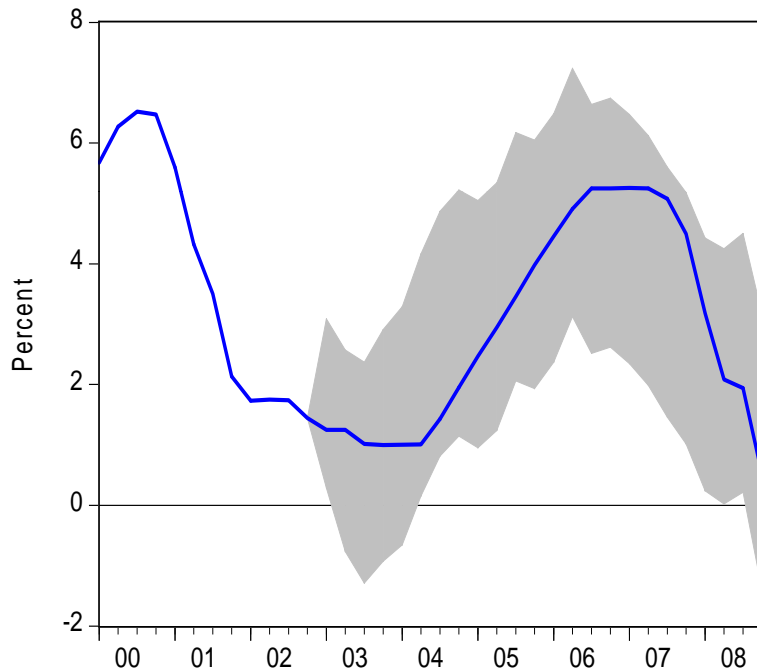


Note: Shaded areas refer to NBER recessions.

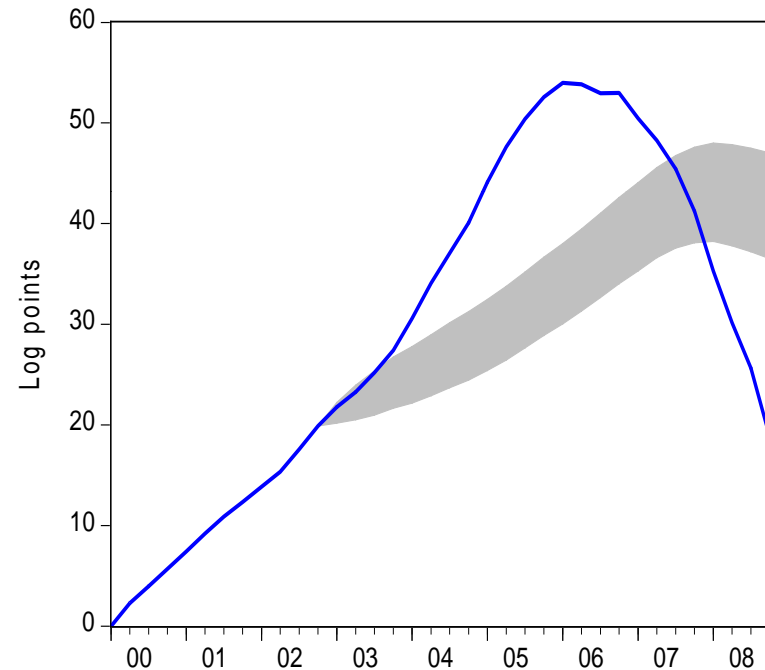
Source: FirstAmerican LoanPerformance.

Conditional Forecasts for the Federal Funds Rate and House Prices

Federal Funds Rate



Real House Prices



Note: Shaded areas denote values within 2 standard deviations of the conditional forecast of each variable.

Source: Federal Reserve Board, Bureau of Economic Analysis, FirstAmerican LoanPerformance, and Federal Reserve staff calculations.

Alternative Mortgage Instruments and Associated Initial Monthly Payments

Mortgage Product	Initial Monthly Payment	Payment as a Percentage of FRM Payment
Fixed-rate mortgage (FRM)	\$1,079.19	100.0
Adjustable-rate mortgage (ARM)	903.50	83.7
Interest-only/ARM	663.00	61.4
40-year amortization (ARM)	799.98	74.1
Negative amortization ARM	150.00	13.9
Pay-option ARM	<150.00	<13.9

Note: Interest rates used in these calculations were 6.00 percent for FRMs and 4.42 percent for standard ARMs. For purposes of the calculations, we assume a house price of \$225,000 and a 20 percent down payment, and that the borrower qualifies for a prime product.

Source: Interest rates for these calculations are from Freddie Mac and are for the period from 2003 through 2006.

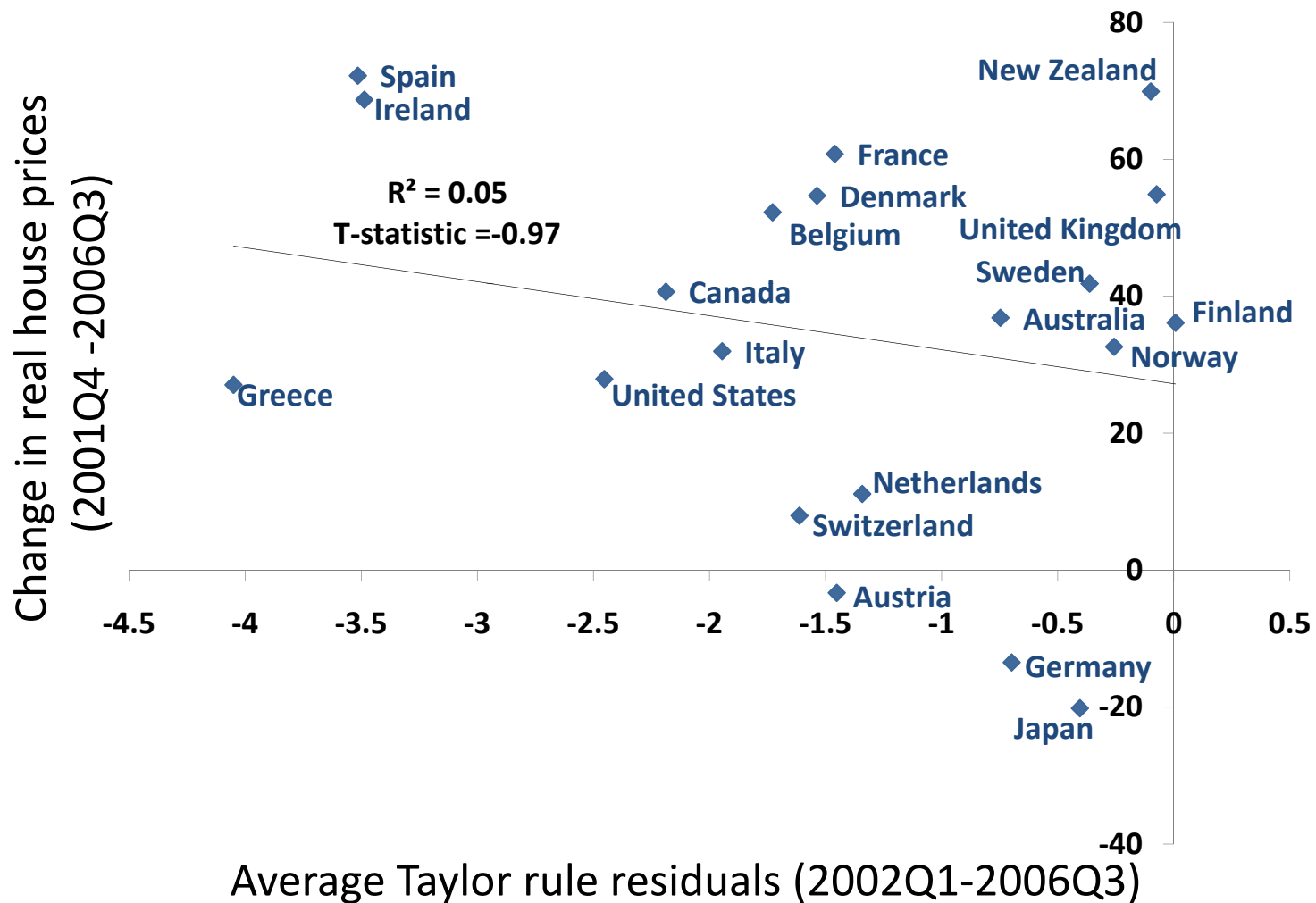
Nontraditional Mortgage Features

(Percent of ARM originations)

	Interest Only		Extended Amortization		Negative Amortization	Pay-Option
	Subprime	Alt-A	Subprime	Alt-A	Alt-A	Alt-A
2000	0	3	0	0	---	---
2001	0	8	0	0	---	---
2002	2	37	0	0	---	---
2003	5	48	0	0	19	11
2004	18	51	0	0	40	25
2005	21	48	13	0	46	38
2006	16	51	33	2	55	38

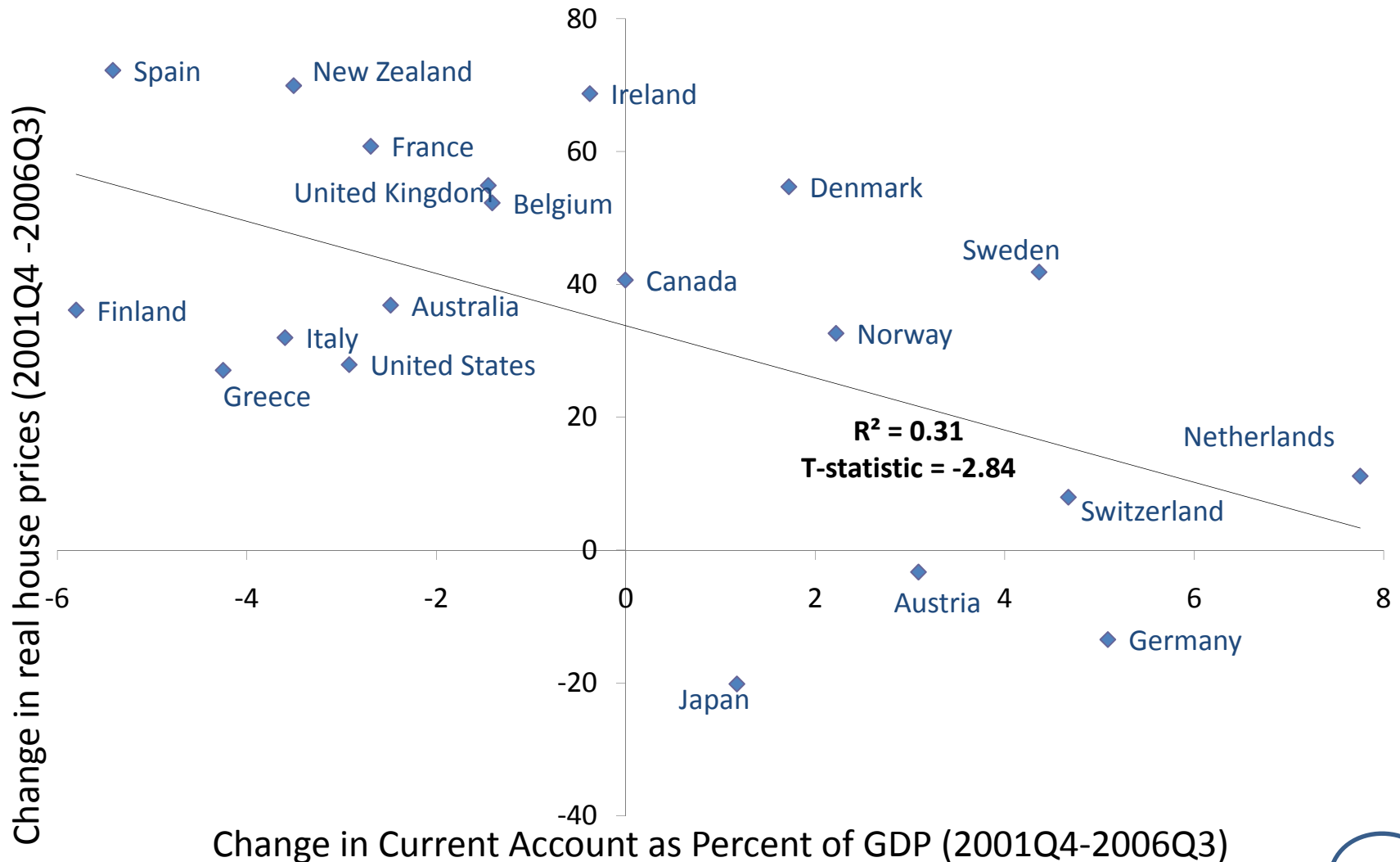
Source: Calculations based on data from First American LoanPerformance.

Monetary Policy and House Prices in the Advanced Economies



Source: International Monetary Fund.

Current Accounts and House Prices in the Advanced Economies



Source: International Monetary Fund, Haver Analytics, and Federal Reserve staff calculations.